

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-MPM DEPLOY PMEA NO 02-5B-P04-1 REV 0000

ASSEMBLY : MPM DEPLOYMENT MECHANISM
P/N RI : V082-544900
P/N VENDOR: - -
QUANTITY : 24

	VEHICLE	102	103	104
EFFECTIVITY:	X	X	X	X
PHASE(S):	PL	LO	OO	X DO X

	REDUNDANCY SCREEN:	A-PASS	B-PASS	C-PA
PREPARED BY:	APPROVED BY:	APPROVED BY (NASA):		
DES D. S. CHEUNG	DES <i>[Signature]</i>	SSM <i>[Signature]</i>		
REL M. B. MOSKOWITZ	REL <i>[Signature]</i>	REL <i>[Signature]</i>		
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ITEM:

BEARING, DRIVESHAFT

FUNCTION:

REDUNDANT POWER DRIVE UNIT (PDU) MOTORS DRIVE THOROUGH TORQUE LIMITERS AND THE PDU GEARBOX TO PROVIDE TORQUE TO THE MANIPULATOR POSITIONING MECHANISM (MPM) DRIVESHAFT WHICH IN TURN DRIVES THE SHOULDER AND FORWARD/MID/AFT PEDESTAL ROTARY DRIVE GEARBOX/DRIVE LINKAGES. THE DRIVESHAFT BEARINGS SUPPORT THE DRIVESHAFT.

FAILURE MODE:

FAILS TO ROTATE

CAUSE(S):

ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, CORROSION, DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT, EXCESSIVE LOAD, LOSS OF LUBRICANT

EFFECTS ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) FAILURE WILL CAUSE THE DRIVESHAFT TO JAM/FREEZE AND RESULT IN A LOSS OF ABILITY TO POSITION ALL MPM.

(B) FAILURE WILL RESULT IN LOSS OF ABILITY TO POSITION MPM CAUSING POTENTIAL INTERFERENCE WITH PAYLOAD BAY (PLB) DOOR CLOSURE.

(C) FAILURE WILL RESULT IN POSSIBLE LOSS OF MISSION DUE TO BLOCKAGE OF PAYLOAD DEPLOYMENT/RETRIEVAL ENVELOPE OR INABILITY TO DEPLOY REMOTE MANIPULATOR SYSTEM (RMS).

(D) FAILURE WILL REQUIRE JETTISON OF MPM TO PREVENT POSSIBLE LOSS OF CREW/VEHICLE DUE TO INTERFERENCE WITH PLB DOOR CLOSURE.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : P/L RETEN & DEPLOY-MPM DEPLOY FMEA NO 02-5B-P04-1 REV:07/28/81

DISPOSITION & RATIONALE:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) DESIGN

RING AND BALLS OF THE BEARING ARE MADE OF HIGH STRENGTH MATERIAL (STEEL FED-STD-66, E52100). POLYTETRAFLUOROETHYLENE PER AMS3652 HAS BEEN USED FOR THE BEARING SEAL. ROTATING SURFACES IN THE BEARING HAVE BEEN LUBRICATED WITH BRAYCOTE 3L-38RP. THE BEARING USED IN MPM DEPLOYMENT MECHANISM IS SINGLE ROW BALL BEARING WHICH IS STANDARD TYPE FOR TORQUE TUBE ROTATION SYSTEM.

(B) TEST

QUALIFICATION TESTS: THE MPM DEPLOYMENT ACTUATOR MC287-0037-0006/-0007 IS CERTIFIED PER CR-29-287-0037-0001G (REF FMEA/CIL 02-5B-P01-3) THE MANIPULATOR POSITIONING MECHANISM INSTALLATION IS CERTIFIED PER CR-44-000002E. THE SYSTEM INSTALLATION QUALIFICATION TEST INCLUDED: ACCEPTANCE (TO CONFIRM ALL COMPONENTS HAVE BEEN ASSEMBLED AND RIGGED PER APPLICABLE DRAWINGS AND SPECIFICATIONS); FLIGHT VIBRATION - 20 TO 2,000 HZ RANGE WITH MAXIMUM OF 0.006 g²/HZ FROM 100 TO 250 HZ FOR 49.5 MINS/AXIS AT LEVEL "A", AND WITH MAXIMUM OF 0.047 g²/HZ FROM 50 TO 250 HZ FOR 49.5 MINS/AXIS AT LEVEL "B"; STIFFNESS TEST - APPLIED LOADS AND MOMENTS (11 CONDITIONS) TO THE SHOULDER MECHANISM (8 CONDITIONS) AND RETENTION FITTING (3 CONDITIONS); LIMIT LOAD - APPLIED LIMIT LOAD AND 115% OF LIMIT LOAD TO THE RETENTION FITTING AND SHOULDER MECHANISM (STOWED AND DEPLOYED POSITIONS); FUNCTIONAL CHECKOUT WITHOUT MANIPULATOR ARM - CYCLED MPM WITH BOTH MOTORS, 40 SEC MAX/DEPLOY STROKE AND 50 SEC MAX/STOWED STROKE; FUNCTIONAL CHECKOUT WITH MANIPULATOR ARM - CYCLED EACH RETENTION LATCH TO THE LATCHED AND UNLATCHED POSITION WITH BOTH MOTORS, 7.5 SEC MAX/LATCH AND UNLATCH STROKE AND REPEATED DEPLOY AND STOW CYCLES OF MPM.

QUAL TESTS ALSO INCLUDE: HORIZONTAL OPERATION - CYCLED 115 TIMES AT +70 DEG F, 60 TIMES AT +25 DEG F, 100 TIMES AT +168 DEG F WITH ENGINEERING ARM INSTALLED CYCLED 100 TIMES AT -100 DEG F AND 100 TIMES AT +250 DEG F WITHOUT THE ENGINEERING ARM INSTALLED; SEPARATION SHOULDER/PEDESTAL - PERFORMED 4 PYRO SEPARATIONS (2 FOR SHOULDER AND 2 FOR RETENTION FITTING); READY-TO-LATCH INDICATION - OPERATED STRIKER BAR 500 TIMES AT AMBIENT TEMPERATURE, 20 TIMES AT -50 DEG F, 500 TIMES AT -100 DEG F AND 500 TIMES AT +168 DEG F; LIMIT LOAD (LANDING CASE) - APPLIED LIMIT LOADS AND 115% LIMIT LOADS TO SHOULDER MECHANISM IN STOWED POSITION; MECHANICAL STOP TEST - THE MPM DRIVE MECHANISM WAS OPERATED INTO ITS STOPS TEN TIMES; DELTA QUAL TEST - WITH DOWEL PIN INSTALLED THE SHOULDER MECHANISM IN DEPLOYED POSITION WAS SUBJECTED TO LIMIT LOADS; VERTICAL OPERATIONS - CONDUCTED 75 CYCLES AT ROOM AMBIENT CONDITIONS; ULTIMATE LOADS - CONDUCTED ULTIMATE LOADS ON RETENTION FITTING AND ON SHOULDER MECHANISM PYRO SEPARATION - WITH DOWEL PIN INITIATED PYRO SEPARATION.

ACCEPTANCE TESTS: THE MPM ACCEPTANCE TEST CONSISTED OF CONFIRMATION OF ACCEPTANCE DATA APPLICABLE TO ASSEMBLY AND RIGGING.

OMRSD: GROUND TURNAROUND INCLUDES MPM DEPLOY (SYSTEMS 1 AND 2) AND MPM STOW (SYSTEMS 1 AND 2).

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(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESS CERTIFICATIONS ARE VERIFIED BY RECEIVING INSPECTION

CONTAMINATION CONTROL

CORROSION PROTECTION IS REQUIRED AND VERIFIED BY INSPECTION. CLEANLINES IS MAINTAINED PER APPLICABLE SPECIFICATION AND VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MATERIAL USED FOR FABRICATION OF SHAFT IS VERIFIED BY INSPECTION ON MANUFACTURING ORDERS. MACHINE TOLERANCES ARE PER DRAWING AND MACHINING SPECIFICATION. SPECIAL CALLOUT FOR SPLINE MACHINING IS FLAGGED OUT ON DRAWING DATA BLOCK, AND KEYWAY SLOT CLOSE TOLERANCE ARE VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATING IS VERIFIED BY INSPECTION.

TESTING

ATP IS OBSERVED AND VERIFIED PER PROCEDURE.

HANDLING/PACKAGING

PARTS ARE PACKAGED PER APPLICABLE SPECIFICATIONS AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

CAR NO. AB9590 : DURING INSTALLATION OF THE MANIPULATOR POSITIONING MECHANISM ON OV102 AT KSC, THE DRIVESHAFT BEARING JAMMED; THE JAMMED CONDITION WAS ATTRIBUTED TO A COMBINATION OF A HIGH RADIAL PLAY AND A MINIMUM FILLING SLOT HEIGHT; SUSPECT BEARING WAS SCRAPPED AND A NEW BEARING WAS INSTALLED WHILE ALL BEARINGS IN STOCK WERE RETURNED TO THE SUPPLIER FOR RADIAL FREEPLAY MEASUREMENT.

(E) OPERATIONAL USE

THE MPM MAY BE JETTISONED IF PREVENTING PLB DOOR CLOSURE. EXTRA-VEHICULAR ACTIVITY (EVA) PROCEDURES WILL NOT BYPASS THIS FAILURE.